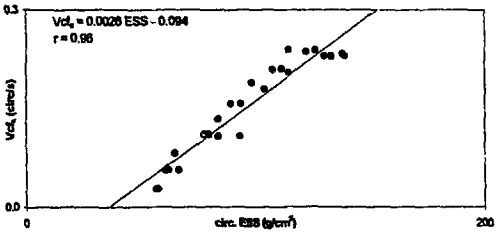
997 Pediatric Cardiology: Ventricular

Wednesday, March 27, 1996, 9:00 a.m.–11:00 a.m.
Orange County Convention Center, Hall E
Presentation Hour: 9:00 a.m.–10:00 a.m.

997-8 Left Ventricular Contractility in a Cyanotic, Univantricular Swine Model

Robert J.M. Klautz, Gary S. Haas, Jan Baan, David F. Teitel. *University of California, San Francisco, CA; University Hospital Leiden, The Netherlands*

To study the effects of right ventricular exclusion and cyanosis (RVX) on left ventricular (LV) function, we created a swine model of triculspid atresia with a bidirectional Glenn shunt by diverting inferior vena cava blood to the left atrium (IVC-LA) and superior vena cava blood to the pulmonary artery using Gore-Tex shunts. One month later we studied baseline contractility, hemodynamics and LV contractile response to frequency (atrial pacing) and β-adrenergic (dobutamine) stimulation. Contractility was assessed by the slope of the end-systolic pressure-volume relationship (E_{es}). LV volume was measured by the conductance catheter method. The RVX data (n = 7) were compared with non-surgical controls (n = 7) and a cyanotic group (n = 7), which had undergone only the IVC-LA connection. All 3 groups had similar baseline hemodynamics and contractility. All had significant increases in contractility in response to atrial pacing and dobutamine. But, although all groups had a similar chronotropic response to dobutamine, the contractile response in both the RVX and cyanotic groups was significantly less than that in controls (graph).

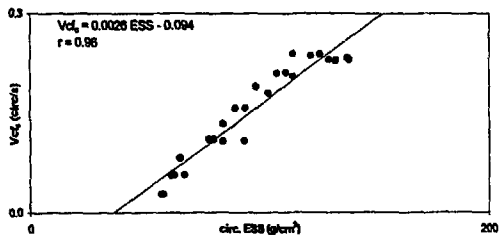


We conclude that RV exclusion with cyanosis decreases contractile reserve to β-adrenergic stimulation, but that this decreased reserve is induced by cyanosis rather than by the functional absence of the right ventricle.

997-9 Preload Dependence of the End-Systolic Wall Stress-Velocity of Fiber Shortening Relation in the Neonatal Left Ventricle

Michael J. Davies, Renée L. Quarterman, Steven S.L. Tsui, Ross M. Ungerleider, J. William Gaynor. *Duke Jriversity Medical Center, Durham, NC*

The left ventricular (LV) end-systolic wall stress-rate corrected mean velocity of fiber shortening relation (ESS-Vcf$_c$) has been utilized as a single-beat, load-insensitive index of contractility in children. To assess the effects of changes in preload on the ESS-Vcf$_c$ relation in the neonatal LV, 22 piglets (age 7 ± 1 days, weight 2.9 ± 0.2 kg) were instrumented with epicardial ultrasonic dimension transducers and a LV micromanometer. After autonomic blockade, preload was varied by transient vena caval occlusions (VCO). End-diastolic volume fell 20 ± 6% and end-diastolic pressure fell 66 ± 40% (both $p < 0.001$) during VCO. ESS fell 45 ± 15% and the Vcf$_c$ fell 71 ± 26% (both $p < 0.001$) during VCO resulting in a significant shift in the ESS-Vcf$_c$ relation as shown for one typical animal.



These findings demonstrate that the ESS-Vcf$_c$ relation is significantly preload dependent and may have limited utility as a single-beat index of contractility in the neonatal left ventricle.

997-10 Administration of Intravenous Triiodothyronine Has a Positive Inotropic Effect on the Neonatal Left Ventricle

Renee Quarterman, Michael J. Davies, Louis R. DiBernardo, Paul M. Kirshbom, Ross M. Ungerleider, J. William Gaynor. *Duke University Medical Center, Durham, NC*

Intravenous Triiodothyronine (T_3) has been advocated as a positive inotropic agent. However, there is controversy as to whether T_3 exerts a positive inotropic effect or whether it improves cardiac performance by altering loading conditions. The possible inotropic effects of T_3 have not been previously evaluated in the immature heart. The cardiac response to T_3 was examined in 16 neonatal piglets (7–9 days old, 2.8 ± 0.1 kg) instrumented with epicardial ultrasonic diameter transducers and a left ventricular (LV) micromanometer. After autonomic blockade, data acquisition was performed at steady state and during transient inferior vena caval occlusions. Control animals (n = 8) received no drug; T_3 animals (n = 8) received 1.2 μg/kg of T_3 as an intravenous bolus. The slope of the preload recruitable stroke work (PRSW) relationship, a load-independent index of ventricular function, was used to evaluate changes in LV inotropic state. At baseline, heart rate (HR), mean ejection pressure (MEP), end diastolic pressure (EDP), end diastolic volume (EDV) cardiac output (CO) and the slope of the PRSW relationship were the same for both groups ($p > 0.2$). Three hours after drug infusion; HR and EDV were not significantly different between groups ($p > 0.05$). There was a trend towards a lower EDP (3.8 ± 0.9 vs 5.9 ± 1.5 mmHg) with an increased CO (329 ± 52 vs 285 ± 48 ml/min) and MEP (69 ± 7 vs 63 ± 5 mmHg) in the T_3 animals which did not reach statistical significance ($p > 0.05$). However, the slope of the PRSW relationship had significantly increased in the T_3 group compared to the control animals (61.0 ± 14.1 erg-cm^3 -10^3 vs. 46.3 ± 9.0 erg-cm^3 -10^3, $p < 0.05$) indicating an increase in inotropic state. These data demonstrate that T_3 administration has a positive inotropic effect on the neonatal left ventricle.

997-11 Left Ventricular Function Following Apical Left Ventriculotomy for Closure of Muscular Ventricular Septal Defects

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Left ventriculotomy in children is believed to cause severe myocardial injury with reports of up to 50% mortality and significant morbidity. Thirteen children had a limited apical left ventriculotomy for closure of apical muscular ventricular septal defects (VSDs) at the University of Michigan between January 1988 and December 1994. All are alive without significant cardiac symptoms by parental report. Nine patients were prospectively assessed with an electrocardiogram, 24 hour Holter monitor scan, radionuclide angiocardiography using multiple gated acquisition (MUGA), and an echocardiogram, at a mean follow-up of 47 months after surgery (range 12–84 months). Left ventricular ejection fraction (LVEF) measured by echocardiography using the biplane Simpson's method ranged from 44–63% (median 55%). LVEF measured by MUGA ranged from 39–70% (median 54%). Three children had a LVEF by echocardiography of ≤ 50%, 2 of whom also had a LVEF by MUGA ≤ 50%. No significant residual VSDs were identified. Two patients had tiny muscular VSDs imaged. No patient had ST-T wave changes indicative of myocardial ischemia but 3 children had ST-T wave changes due to bundle branch block. There were no ventricular rhythm disturbances beyond grade II ventricular ectopy on Holter scans. One child with Holt-Oram syndrome had complete heart block and one child had an intermittent junctional escape rhythm.

Apical left ventriculotomy for closure of apical VSDs yields a satisfactory outcome and should be considered as a therapeutic option in infants and children with significant apical muscular VSDs when other surgical approaches are not satisfactory.

997-12 Pulmonary Atresia With Intact Septum: Growth of the Right Ventricle and Tricuspid Valve Following Primary Procedure

P.E.F. Daubeney, Z. Slavik, B.R. Keeton, R.H. Anderson, S.A. Webber. *The UK and Eire Collaborative Study of Pulmonary Atresia With Intact Ventricular Septum (PAIVS), Wessex Cardiothoracic Centre, Southampton, UK*

The initial surgical strategy for PAIVS is critical not only for survival but also for the growth potential of the right ventricle (RV) and tricuspid valve (TV). As part of the UK and Eire Collaborative Study of PAIVS (an on-going population based study of *all* children born in the UK and Eire since 1/1991) we examined the growth of the TV and RV following primary procedure. Serial echoes were reviewed in 61 children both pre- and post-primary procedure (mean 17 months post-procedure, range 2–45). The TV annulus and RV inlet length were measured in the 4 chamber view. Z scores were derived